SYSTEMS AND METHODS TO CONTROL A POWER SPLIT BETWEEN ENERGY GENERATION AND ENERGY STORAGE ASSETS

FIELD OF THE INVENTION

[0001] The present subject matter relates generally to energy generation and storage systems and more particularly, to systems and methods to determine a power split between one or more energy generation assets and one or more energy storage assets.

BACKGROUND OF THE INVENTION

[0002] Power generation facilities can be configured to deliver various grid services for revenue generation. For instance, power generations systems, such as renewable energy plants, can be configured to respond to requests for grid services, such as peak shaving, frequency response, ramp rate control, purchasing and selling of energy, load following, energy arbitrage, and other grid services. Typically, power generation facilities provide grid services in modal fashion such that the power generation facility responds to power demands for a single grid service at a time.

[0003] Energy storage systems have become increasingly used to deliver power to utility grids either as part of standalone energy storage systems or as part of a renewable energy farm (e.g., a wind farm or solar farm) with an integrated energy storage system. Energy storage systems can include one or more battery banks or other energy storage devices that can be coupled to the grid via a suitable power converter. Energy storage systems are unique in that energy storage systems have the ability to both deliver and reserve energy for particular grid services.

BRIEF DESCRIPTION OF THE INVENTION

[0004] Aspects and advantages of embodiments of the present disclosure will be set forth in part in the following description, or may be learned from the description, or may be learned through practice of the embodiments.

[0005] One example aspect of the present disclosure is directed to a method for controlling an energy generation and storage system. The method includes accessing, by one or more control devices, data indicative of a grid service request. The method includes determining, by the one or more control devices, a plurality of response scores respectively for a plurality of candidate responses to the grid service request. Each candidate response includes one or more operational parameters of the energy generation and storage system. The one or more operational parameters include at least a split value that describes a power split between one or more energy generation assets and one or more energy storage assets of the energy generation and storage system. The response score determined for each candidate response is based at least in part on an asset life impact value that describes an impact that such candidate response would have on an asset life of at least one of the one or more power generation assets and the one or more energy storage assets of the energy generation and storage system. The method includes selecting, by the one or more control devices, one of the candidate responses as a desired response to the grid service request based at least in part on the plurality of response scores. The method includes controlling, by the one or more control devices, the energy generation and storage system according to at least the split value of the desired response.

[0006] Another example aspect of the present disclosure is directed to an energy generation and storage system that includes one or more energy generation assets, one or more energy storage assets, and a system controller communicatively coupled to the one or more energy generation assets and to the one or more energy storage assets. The system controller includes at least one processor and a non-transitory computer-readable medium storing instructions that, when executed by the at least one processor, cause the system controller to receive data indicative of a grid service request. The instructions cause the system controller to identify a plurality of candidate responses to the grid service request. Each candidate response includes one or more operational parameters. The one or more operational parameters include at least a split value that describes a power split between the one or more energy generation assets and the one or more energy storage assets. The instructions cause the system controller to determine a plurality of response scores respectively for the plurality of candidate responses based at least in part on a plurality of asset life impact values that describe an impact that the plurality of candidate responses would have on an asset life of at least one of the one or more power generation assets and the one or more energy storage assets. The instructions cause the system controller to select one of the plurality of candidate responses as a desired response to the grid service request based at least in part on the plurality of response scores. The instructions cause the system controller to control the energy generation and storage system according to at least the split value of the desired response.

[0007] Another example aspect of the present disclosure is directed to a system controller for controlling one or more energy generation assets and one or more energy storage assets. The system controller includes at least one processor and a non-transitory computer-readable medium storing instructions that, when executed by the at least one processor, cause the system controller to receive data indicative of a grid service request. The instructions cause the system controller to identify a plurality of candidate responses to the grid service request. Each candidate response includes one or more operational parameters. The one or more operational parameters include at least a split value that describes a power split between the one or more energy generation assets and the one or more energy storage assets. The instructions cause the system controller to obtain state of asset data for at least one of the energy generation assets and energy storage assets. The state of asset data for the at least one asset describes at least one of a state of health, a state of charge, a state of emissions, and an efficiency for such asset. The instructions cause the system controller to determine, for each of the plurality of candidate responses, an asset life impact value that describes an impact to an asset life of one or more of the energy generation assets and the energy storage assets due to such candidate response. The asset life impact value determined for at least one of the energy generation assets or the energy storage assets is based at least in part on the state of asset data obtained for such energy generation asset or energy storage asset. The instructions cause the system controller to determine, for each of the plurality of candidate responses, a potential revenue value provided by such candidate response. The instructions